Maharashtra Institute of Technology, Aurangabad
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Quest for Excellence

MAHARASHTRA INSTITUTE OF TECHNOLOGY, AURANGABAD

An Autonomous Institute Affiliated to

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra (India)

Third Year B.Tech. Syllabus (Computer Science and Engineering) 2023-24

T. Y. B. Tech. Syllabus Structure w.e.f. 2023-24 (Pattern 2021-22)

Computer Science and Engineering

Semester – V

Sr. No	Course Category	Course Code	Course Title	L	T	P	Contact Hr./Wk	Credits	MSE-I	MSE-II	CIE	TA	ESE/ Oral	Total
		Orientation Program (1 Day)												
1.1	HSMC	HSM301	Engineering Economics & Financial Management	3	-	-	3	3	15	15	10	10	50	100
1.2	PC	CSE301	Design and Analysis of Algorithms	3	-	-	3	3	15	15	10	10	50	100
1.3	PC	CSE302	Operating System	3	-	-	3	3	15	15	10	10	50	100
1.4	PC	CSE303	Software Process and Project Management	3	-	-	3	3	15	15	10	10	50	100
1.5	PC	CSE304	Formal Languages and Automata Theory	3	-	-	3	3	15	15	10	10	50	100
1.6	PC	CSE321	Lab-I: Design and Analysis of Algorithms	-	-	2	2	1	-	-	-	25	-	25
1.7	PC	CSE322	Lab-II: Operating System	-	-	2	2	1	-	-	-	-	25	25
1.8	PC	CSE323	Lab-III: MERN Stack	-	-	2	2	1	-	-	-	-	25	25
1.9	PRO	CSE324	Lab-IV: Seminar	-	-	2	2	1	-	-	-	-	25	25
1.10	PRO	CSE325	Lab-V: Experience Based Learning	-	-	2	2	1	-	-	-	25	-	25
1.11	PC	CSE326	Lab-VI: Development of Skills (Computational) UI/ UX Design	-	-	2	2	1	-	-	-	25	-	25
				15	0	12	27	21	75	75	50	125	325	650

Semester – VI

Sr. No	Course Category	Course Code	Course Title	L	T	P	Contact Hr./Wk	Credits	MSE-I	MSE-II	CIE	TA	ESE/ Oral	Total
2.1	PC	CSE351	Cryptography and Network Security	3	-	-	3	3	15	15	10	10	50	100
2.2	PC	CSE352	Principles of Compiler Design	3	-	-	3	3	15	15	10	10	50	100
2.3	PC	CSE353	Machine Learning	3	-	-	3	3	15	15	10	10	50	100
2.4	PC	CSE354	Cloud Computing	3	-	-	3	3	15	15	10	10	50	100
2.5	OE	CSE391-392	Open Elective-III	3	-	-	3	3	15	15	10	10	50	100
2.6	PC	CSE371	Lab-I: Cryptography and Network Security	-	-	2	2	1	-	-	-	25	-	25
2.7	PC	CSE372	Lab-II: Principles of Compiler Design	-	-	2	2	1	-	-	-	25	-	25
2.8	PC	CSE373	Lab-III: Machine Learning	-	-	2	2	1	-	-	-	-	25	25
2.9	PC	CSE374	Lab-IV: Cloud Computing	-	-	2	2	1	-	-	-	-	25	25
2.10	PRO	CSE375	Lab-V: Major Project-I	-	-	4	4	2	-	-	-	25	25	50
				15	0	12	27	21	75	75	50	125	325	650

MSE- Mid Semester Exam, ESE- End Semester Examination, TH-Theory, OR- Oral, CIE: Continuous Internal Evaluation, TA-Teacher Assessment; TW- Term Work, PR- Practical, Tut- Tutorial

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TY OPEN ELECTIVE-III (ALL)

DEPARTMENT OFFERED	COURSE CODE	COURSE TITLE
Agricultural Engineering	AED391	Fundamentals of Bioenergy
Civil Engineering	CED391	Solid Waste Management
Computer Science and Engineering	CSE391	RHCSA (RedHat Certified System Administration)
Computer Science and Engineering	CSE392	Digital Marketing
Electronics and Computer Engineering	ECE391	Data Science
Electronics and Computer Engineering	ECE392	Control Systems
Electrical Engineering	EED391	Special Purpose Electric Machines
Emerging Science and Technology	AID391	Business Intelligence
Mechanical Engineering	MED391	Industry 4.0
Mechanical Engineering	MED392	Operations Research
Plastic and Polymer Engineering	PPE391	Waste Management and Circular Economy

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(Faculty of Science & Technology) Syllabus of Third Year B. Tech. (All) Semester V	
Course Code: HSM301 Course: Engineering Economics & Financial Management **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II:15 Marks Continuous Internal Evaluation: 10 Marks TeacherAssessment:10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	Basic knowledge of concepts of economics.
Objectives	The objectives of the course are 1. Understanding the principles of economics. 2. Analyzing cost-benefit analysis. 3. Recognizing the role of markets and competition. 4. Understand decision making in uncertainty. 5. Getting introduced to Indian taxing system.
Unit-I	**Introduction to Engineering Economics:** Introduction to Economics, Importance and scope of economics in engineering, Economic analysis and its role in project management, Overview of economic principles and concepts relevant to engineering, Micro - and macro- economics, economics of growth and development, Demand and supply analysis. **(6 Hrs)**
Unit-II	**Cash Flow and Time Value of Money** Interest rates, compounding, and discounting, Present value and future value analysis, Equivalent annual cost analysis. Cash Flow – Diagrams, Categories & Computation, Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis , Calculating Rate of Return, Incremental Analysis. **(6 Hrs)**

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Unit-III	**Elements of Managerial Economics** Cost &Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming, Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cashflows), Business Forecasting – Elementary techniques. **(6 Hrs)**
Unit-IV	**Rate analysis and Tendering** Rate analysis - Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity. **(3 Hrs)** Tendering - Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification, general and special conditions, termination of contracts, penalty and liquidated charges, Settlement of disputes. Bid conditions, alternative specifications, Alternative Bids, Bid process management. **(3 Hrs)**
Unit-V	**Decision-making under Risk and Uncertainty** Probability and risk assessment in engineering projects, Sensitivity analysis and scenario analysis, Decision trees and expected value analysis, Real options analysis. **(3 Hrs)** **Depreciation** Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation. **(3 Hrs)**
Unit-VI	**Personal Financial Management** Insurance, Investment, Insurance Vs investment, Investment types, Equity and debt, Investment options, lumpsum, SIP, STP, Compounding effects of investment, Investment analysis, Introduction to Stock market, fundamental and technical analysis, Derivatives, Types of derivatives, Trading awareness. **(3 Hrs)** Indian Taxing System, Types of tax: Direct and indirect taxation in India, Excise duty, GST, Income tax introduction, Income Tax calculations, example. **(3 Hrs)**

	Sr. No.	Title	Author	Publication	Edition
Textbooks / Reference Books	1.	Economics for Engineers	James L.Riggs, David D. Bedworth, Sabah U. Randhawa	McGraw-Hill	4th
	2.	Engineering Economics Analysis	Donald Newnan, Ted Eschembach, Jerome Lavelle	OUP	8th
	3.	Principle of Engineering Economic Analysis	John A. White, Kenneth E. Case, David B. Pratt	John Wiley	6th
	4.	Engineering Economics	R. Paneerseelvam	PHI	2nd
	5.	Engineering Economics Analysis	Michael R Lindeburg	Professional Pub	1993
	6.	Managerial Economics	V. Mote, S. Paul, G. Gupta	Tata McGraw Hill	2004
	7.	Principles of Economics	Mankiw Gregory N.	Thompson Asia	2002

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester V)	
Course Code: CSE301 Course: Design and Analysis of Algorithms **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisites	Programming in C Language, Discrete Mathematical Structure, Data Structures
Objectives	1. To provide a detailed introduction to different algorithm design paradigms with illustrative problems 2. To analyze asymptotic runtime complexity of algorithms including formulating recurrence relations. 3. To compare and contrast the performance of various algorithms.
Unit-I	**Introduction to Algorithms** Definition, Properties of Algorithms, Expressing Algorithm, Flowchart, Algorithm Design Techniques, Performance Analysis of Algorithms, Types of Algorithm's Analysis, Order of Growth, Asymptotic Notations, Recursion, Recurrences Relation, Substitution Method, Iterative Method, Recursion Tree, Master Theorem. **(6 Hrs)**
Unit-II	**Divide and Conquer** Divide and conquer: basic algorithm and characteristics. Binary Search:method and analysis of binary search for best, worst and average case for searches. Quick Sort, Merge Sort : method and analysis of algorithms, Strassen's matrix multiplication. **(6 Hrs)**

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Unit-III	**Greedy Method** Introduction to Greedy Technique, Greedy Method, Optimal Merge Patterns, Huffman Coding, Knapsack Problem, Activity Selection Problem, Job Sequencing with Deadline, Single-Source Shortest Path Algorithm. **(6 Hrs)**
Unit-IV	**Dynamic Programming** Dynamic Programming Method: basic algorithm and characteristics, 0/1 Knapsack Problem solving using DP method, Multistage graphs, All pair shortest Path, Optimal binary search trees, Travelling salesperson problem. **(6 Hrs)**
Unit-V	**Backtracking and Branch and Bound technique** Backtracking Method: basic algorithm and characteristics, Solving n-queens problem, Sum of subsets problem, Graph colouring, Branch and bound: basic algorithm and characteristics. 15-puzzle, solving Travelling salesperson problem using branch & bound. **(6 Hrs)**
Unit-VI	**Introduction to Complexity Theory** Introduction, Class P, Class NP, NP Completeness, NP Hardness, Cook Levine Theorem Reduction of standard NP Complete Problems -SAT, 3SAT, Clique. **(6 Hrs)**

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Fundamentals of Computer Algorithms	Ellis Horowitz, Sarataj Sahni, S. Rajasekaran	University Press (India) Private Ltd.	2nd
2.	Introduction to Algorithms	Thomas H.Cormen	PHI	2nd
3.	Design and Analysis of Computer Algorithms	Aho, Hopcroft and Ullman	Pearson	1st
4.	Algorithms in a Nutshell- A Practical Guide	George T. Heineman, Gary Pollice, Stanley Selkow	O'Reilly Media	2nd
5.	Computer algorithms: Introduction to Design and Analysis	Sara Base	Addison-Wesley	2nd

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester V)	
Course Code: CSE302 Course: Operating System **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisites	C Programming, Data Structures, Computer Organization
Objectives	1. Student should learn fundamentals which will help them to understand design of modern operating system. 2. To study different components of OS. 3. Students should have overview of different Types and Structures of OS. 4. Students should learn important system resources and their management policies.
Unit-I	**Introduction** Operating System Objectives and Functions: The OS as a User/Computer Interface, OS as a resource manager. Evolution of Operating system: Batch System, multiprogramming, time sharing, multitasking, distributed, handheld Computer System, Embedded OS, Real Time, Smart Card OS. Cloud OS, Operating System Structure: Monolithic Systems, layered Systems. Micro Kernels, Client Server Model, Virtual Machines. Exokernels. System Calls and Shell. **(6 Hrs)**
Unit-II	**Process Management** Process concept. Process states (two state, five state), Process Description, PCB. CPU scheduling- scheduling criteria, Scheduling Algorithms. Thread: Process and Threads, Thread functionality, User level and Kernel level threads. Process Synchronization, Principle of concurrency, Race condition. Critical Sections/Regions, Mutual Exclusion, Sleep and wakeup, Producer - Consumer problem, Semaphore, Monitors, Message Passing. Dining Philosopher Problem, Readers and Writers' problem. **(6 Hrs)**

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Unit-III	**File Systems** Overview: File, File Management System, File System Architecture, File Management Functions. File Organization and access, File System Layout. File Directories, File Sharing. Secondary Storage Management: File Allocation, Disk space management. File System Consistency and Performance, Comparison of Windows, and UNIX File System. **(6 Hrs)**
Unit-IV	**Memory Management** Memory Management Requirements, Relocation, Protection, Sharing, Logical Organization, Physical Organization. Memory Partitioning: Fixed, Dynamic Partitioning, Buddy Systems, Relocation Fragmentation, Swapping. Managing free Memory: Memory management with bitmap, linked list. Paging: Basic Method, hardware support, Structure of page Table. Segmentation: Basic Method, hardware. Virtual Memory: Demand Paging, Page replacement Algorithms- optimal, FIFO, LRU, Allocation of Frames, Thrashing and Working Set Model. **(6 Hrs)**
Unit-V	**Device Management** Principles of I/O Hardware: I/0 devices, Device Controllers. Principle of I/O software, I/0 Software Layers, Disk: Disk hardware -Magnetic CDs, DVDs Disk, RAID, Disk Formatting, Disk Scheduling Algorithms, Clocks. **(6 Hrs)**
Unit-VI	**Deadlock and Case study** Deadlock, System model, Characterization, Deadlock Prevention, Deadlock avoidance – Banker's Algorithm for single and multiple resources, Deadlock detection and recovery. Case study of Windows 10 - History of Windows, System Structure, Windows Registry, Process and thread management, Concurrency Control, Memory Management and I/O Management, Security. Case study of Linux - History of Linux, System Structure, file system, Process and thread management, Security. **(6 Hrs)**

	Sr. No.	Title	Author	Publication	Edition
Textbooks / Reference Books	1.	Operating System Concepts	Abraham Silberschatz, Peter Galvin	Addison Wesley	6th
	2.	Modern Operating Systems	Andrew S. Tanenbaum	Prentice Hall	3rd
	3.	Operating System Design & Implementation	Andrew S. Tanenbaum	Pearson Education	2nd
	4.	Operating systems	William Stallings	Prentice Hall	4th

(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester V)	
Course Code: CSE303 Course: Software Process and Project Management **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisites	Database, Data Structures and Object Oriented Concepts
Objectives	1. To acquire knowledge on software process management. 2. To obtain managerial skills for software project development. 3. To understand the basic steps of project planning, project management, quality assurance.
Unit-I	**Introduction to Software Engineering:** SDLC **Software Development Process:** Process, Tailoring the Process, Improving the process discipline - Need for implementing discipline. Software Production Process. **Basic Software Process Models:** Waterfall Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, Component Assembly Model, Agile method. **(7 Hrs)**
Unit-II	**Software Requirement Analysis, Specification** Requirement Analysis, Types of Requirement, and Requirement Elicitation Techniques, Characteristics of SRS, Use Case Approach. Product Specifications, Defining the Final Product, Data Flow Diagram, Data Dictionary, Structured English, Decision Trees, Decision Tables, Feasibility Study. **(6 Hrs)**

Unit-III	**Software Project Management & Organization** Three Vital Aspects of Software Project Management: The Team - Meaningof Leadership, Communicating in Harmony, Personality traits. **Project Organizations.** Project Planning, Top-Down and Bottom-Up Planning, Activities, Types of Activity, Project Scheduling and Staffing. Project Duration: Schedule Monitoring Tools, Gantt Chart, PERT Chart. **(6 Hrs)**
Unit-IV	**Project Review** Tracking Meetings, Recovery plans: Schedule Work & Escalation Meetings. Project Engineering: Product Requirements, Understanding the Customer Problem to solve -Initial Investigation, Strategies for determining information requirements, Information gathering Tools, Product Objectives. **(6 Hrs)**
Unit-V	**Software Quality Management** Software Quality, Quality Measures, FURPS, Software Reviews: Format Technical Review (FTR), Software Reliability: The Software Quality Assurance Plan, Formal approaches to SQA. **Introduction to Software Testing:** Testing Life Cycle, Types of Testing, Test Plan. **(6 Hrs)**
Unit-VI	**CCPDS –R** Case Study and Future Software Project Management Practices Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions. **(5 Hrs)**

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Software Engineering	Roger S Pressman	McGraw Hill	8th
2.	Fundamentals of Software Engineering	Carlo Ghezzi	Prentice Hall India, ISBN-10: 0133056996	1st
3.	An Integrated Approach to Software Engineering.	Pankaj Jalote	Springer, ISBN 13: 9788173192715	3rd
4.	Fundamentals of Software Engineering	Rajib Mall	Prentice Hall India, ISBN-13: 978-8120348981	1st
5.	Handbook of Software	Tom Halt	Clanye	1st

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester V)	
Course Code: CSE304 Course: Formal Languages and Automata Theory **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisites	Discrete Mathematics
Objectives	1. To learn about fundamental concepts of finite automata and formallanguage. 2. To design grammars and recognizers for different formal languages. 3. To create background for designing compiler. 4. To learn about the theory of computability and complexity.
Unit-I	**Introduction to Finite Automata** Definition of deterministic finite automata, non-deterministic finite automata, Finite Automat with output and their conversions, Regular expressions, Recursive definition, NFA with e-moves, Inter-conversion between NFA and DFA, Regular expression and FA, Pumping lemma. **(6 Hrs)**
Unit-II	**Regular Expressions and Languages** Regular Expressions, Finite automata and Regular Expression, Algebraic laws for RE, Ardens theorem, Pumping lemma for Regular languages, Applications of pumping lemma, Closure properties of regular languages, Equivalence and minimization of Automata, Applications of Regular Expressions **(6 Hrs)**

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Unit-III	**Context Free Grammar and Language** Definition, Ambiguous grammar, Removal of ambiguity, Chomsky hierarchy, Left linear, Right linear grammar, Inter-conversion between left linear and right linear regular grammar, Applications of Context-Free Grammars, Definition of context free languages, Simplification of CFG, Normal forms of CFG: CNF, GNF. **(7 Hrs)**
Unit-IV	**Pushdown Automata** Formal definition -Deterministic Pushdown automata (DPDA) – definition, Non-deterministic Pushdown automata (NPDA), Acceptance by PDA, Pumping lemma for CFL, Applications of PDA ,The model of linear bounded Automata. **(5 Hrs)**
Unit-V	**Turing Machines** Definition, Computing with Turing machine, Extensions of Turing machines, Random access Turing machines, Non-deterministic Turing machines, The Church's Turing hypothesis, Universal Turing machines, The Halting problem, Unsolvable problems about Turing machines. **(6 Hrs)**
Unit-VI	**Decidability and recursively enumerable languages** Definition of algorithm, Decidability, Decidable language, Undecidable language, Recursive and recursively enumerable languages, Non recursively Enumerable Languages, The diagonalization Language, Universal Language, Post correspondence problem, Undecidable problems for context free grammars, Markvo Algorithm. **(6 Hrs)**

	Sr. No.	Title	Author	Publication	Edition
Textbooks / Reference Books	1.	Introduction to Automata Theory Languages, and Computation	John E. Hopcroft, Rajeev Motwani , Jeffrey D. Ullman	Pearson Education, ISBN:81-317-1429-2	3rd
	2.	Theory of Computer Science: Automata, Languages and Computation	K.L.P. Mishra, N. Chandrasekaran	PHI , ISBN :978-81-203-2968-3	3rd

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	3.	Introduction to Languages and Theory of Computation,	John C. Martin	McGraw Hill Publication	4th
	4.	Introduction to the Theory of Computation	Michael Sipser	CENGAGE Learning, ISBBN-13:978-81-315-2529-6.	3rd
	5.	Formal Languages and Automata Theory	Basavaraj S. Anami, Karibasappa K. G.	Wiley Publication, ISBN : 978-81-265-2010-7	3rd

(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester V)	
Course Code: CSE321 Course: Lab-I: Design and Analysis of Algorithms **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 Teacher Assessment: 25 Marks
Objectives	1. To implement searching and sorting algorithms using Divide and Conquer technique 2. To implement Greedy algorithms for problem Solving 3. To implement dynamic and backtracking algorithms to solve problems
List of Practical	Design, develop and implement the following programs using C or C++ language 1. Program to implement linear, binary search using recursion. 2. Program for Quick sort using Divide and Conquer 3. Program for Merge sort using Divide and Conquer. 4. Program to implement Fractional Knapsack problem using Greedy method. 5. Program to implement single source shortest path 6. Program to implement Floyd Warshall's algorithm for solving all pairs Shortest Path problem 7. Program to implement 0/1 Knapsack problem using Dynamic programming. 8. Program to implement Traveling sales person problem using Dynamic programming 9. Program to implement 8-Queens' problem using Backtracking. 10. Program to implement sum of subset problem using Backtracking.

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester V)	
Course Code: CSE322 Course: Lab-II: Operating System **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 End Semester Examination/Oral: 25 Marks
Objectives	1. Student should be able to install windows or Linux OS. 2. Students should be able to simulate or implement resource management algorithms.
List of Practical	1. Installation of windows/Linux OS. 2. Hands on Unix/Linux basic commands. 3. Implementation of FCFS CPU scheduling algorithms. 4. Implementation of SJF CPU scheduling algorithms. 5. Implement producer consumer problem with bounded buffer solution with Semaphore. 6. Write a program illustrating various file handling functions. 7. Write a program for copying content of one file to other. 8. Implementation of various memory allocation algorithms, (First fit, best fit and Worst fit). 9. Implementation of FIFO page replacement algorithms. 10. Implementation of FCFS Disk Scheduling algorithm. 11. Case study: Red Hat Linux OS

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester V)	
Course Code: CSE323 Course: Lab-III: MERN Stack **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 End Semester Examination/Oral: 25 Marks
Objectives	1. To understand the usage of various front end and back end Tools. 2. To implement basic JavaScript. 3. To implement web based application using effective database access.
List of Practical	1. Introduction to MERN Stack. Server setup with Express.js and Node.js 2. Write a program to create a webpage using HTML CSS and JavaScript? 3. Write a program to build a Chat module using HTML CSS and JavaScript? 4. Implement a program to create a simple calculator Application using React JS. 5. Write a program to create a voting application using React JS 6. Write a program to create and Build a Password Strength Check using Jquery. 7. Write a program to create and Build a star rating system using Jquery. 8. Using Angular JS Implement input validation. 9. Database management with MongoDB.- Demonstrate Accessing MongoDB from Node.js. 10. Case Study / Mini Project.

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(Faculty of Science & Technology) Syllabus of Third Year B. Tech. (All) Semester V	
Course Code: CSE324 Course: Lab-IV: Seminar **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 End Semester Examination/Oral: 25 Marks
Objectives	• To encourage the students to study advanced engineering developments. • To develop skills in doing literature survey, technical presentation and report preparation. • To prepare and present technical reports. • To encourage the students to use various teaching aids such as power point presentation and demonstrative models.
Guidelines	Each student shall identify a topic of current relevance in his/her branch of engineering, get approval of faculty concerned. To encourage and motivate the students to read and collect recent and reliable information about their area of interest confined to the relevant discipline, from technical publications including peer reviewed journals, conferences, books, project reports etc., prepare a report based on a central theme and present it before a peer audience. Each student shall present the seminar for about 20 minutes duration on the selected topic. The report and the presentation shall be evaluated by a team of faculty members comprising Academic coordinator for that program, seminar coordinator and seminar guide based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the report. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
Evaluation	Distribution of marks for the seminar is as follows: i. Topic Selection and Technical Contents: 30 % ii. Presentation : 20% ,iii. Ability to answer questions : 20% & iv. Report : 30%). Evaluation is based on rubrics prepared based on above guidelines.

(Faculty of Science & Technology) Syllabus of Third Year B. Tech. (All) Semester V	
Course Code: CSE325 Course: Lab-V: Experience Based Learning **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 Teacher Assessment: 25 Marks

Objectives	1. To promote professional skills and knowledge through hands on experience. 2. To inculcate independent learning by problem solving with social context.
Attributes	The following attributes are necessary in some combination, • The goal of experience-based learning involves something personally significant or meaningful to the students. • Students should be personally engaged. • Reflective thought and opportunities for students to write or discuss their experiences should be ongoing throughout the process. • The whole person is involved, meaning not just their intellect but also their senses, their feelings and their personalities. • Students should be recognised for prior learning they bring into the process.
Guidelines	**4 Stages of Experiential Learning Cycle** **1. Concrete Experience:** It describes the hands-on experiences that it is learn from. It's here that to try new things, face problems and step out of our comfort zone. **2. Reflective Observation** Next, it is needed to reflect to learn from the experiences. The 'reflective observation' phase of the experiential learning cycle is all about reflection on the experiences which include both action and feelings. It is a stage get to reflect on what went right and what could be improved? It's also a chance to observe how it could have been done differently and to learn from each other. **3. Abstract Conceptualization** Once it has been identified and understood the defining characteristics of an experience, it can decide on what can be done differently next time. This is a time for planning and brainstorming steps for success.

4. Active Experimentation

The active experimentation phase of the learning cycle is where the experimentation with the ideas is done. It's time to put the plan of action to the test in the real world.

The active experimentation phase of the learning cycle is where there is need to experiment with the ideas. It's time to put plan of action to the test in the real world.

Following activities may be performed under experience-based learning.

- Role Play
- Case Studies
- Field Visits
- Undergraduate Research
- Question generating activity
- Fishbowl
- Make a Mnemonic
- Peer Group Learning
- Group 'Change' Projects
- Creative Problem-Solving

Assessment:

Assessment will be done through following ways.

- Creating a reflective journal or a portfolio
- Essay, report, or presentation (could be arts-based, multimedia or oral) on what has been learnt
- Short answers to questions of a 'why' or 'explain' nature
- One-on-one oral assessments with the instructor
- A project that develops ideas further (individually or in small groups)
- Self-evaluation and/or group evaluation of a task performed

Rubrics shall be prepared for the activities in which the performance is to be evaluated. During process of monitoring and continuous assessment and evaluation the individual and team performance is to be measured. EBL is monitored and continuous assessment is done by mentor and authorities.

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Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester V)

Course Code: CSE326 Course: Lab-VI: Development of Skills (Computational) UI/UX Design **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 Teacher Assessment: 25 Marks

Objectives	1. To understand User Interface and User Experience 2. To understand and apply concepts of UI / UX design. 3. To implement graphical layout of an application / product.
List of Practical	1. Configuring UI / UX tools like Figma / Adobe XD / Sketch / Marvel 2. Intro to design methodologies used by industry professionals for various products / services. 3. To study Wireframe Information Architecture. Create different types of Wireframes (Low, Mid, High fidelity) for an application. 4. Implement interaction design and functional layout. 5. Create a working UI/UX prototype using prototype tools. 6. Implement and launch an application. 7. To implement Sharing and exporting Figma Files. 8. To Implement Interaction and animation using Figma. 9. Creating Social Media Advertisement using online tool and Application. 10. Design Web Application using UI and UX tool (Web based or Mobile Based).

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Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)

Course Code: CSE351	Credits: 3-0-0
Course: Cryptography and Network Security	Mid Semester Examination-I: 15 Marks
	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Continuous Internal Evaluation: 10 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
	End Semester Examination: 50 Marks
	End Semester Examination (Duration): 2 Hrs

Prerequisites	Basic Understanding of Computer Networks
Objectives	1. To understand the fundamentals of Cryptography 2. To acquire knowledge on algorithms used to provide confidentiality, integrity, and authenticity. 3. To understand the various key distribution and management schemes 4. To use encryption techniques to secure data in transit across data networks
Unit-I	**Introduction to the Concepts of Security** Introduction, The Need for Security, Security Approaches, Principles of Security, Types of Attacks, Model for Network Security, Modular Arithmetic, Euclidean and Extended Euclidean algorithm. **(7 Hrs)**
Unit-II	**Introduction to Cryptography Techniques** Introduction, Plain text and Cipher text, Substitution techniques, Transposition techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Possible types of attacks. **(6 Hrs)**
Unit-III	**Symmetric Key Cryptographic Algorithms** Modes of operation, overview of Symmetric key cryptography, Data encryption Standard(DES), Strength of DES,3DES, Advanced Encryption Standard(AES), AES structure, AES Transformation functions, Blowfish. **(5 Hrs)**

Unit-IV	**Public Key Cryptography** Public Key Cryptosystems, Applications for public key Cryptosystems, Requirements for public key Cryptography, public key cryptanalysis, The RSA algorithms, The security of RSA, Diffie-Hellman Key Exchange algorithm, Key exchange protocol, Man-in-the Middle Attack. **(6 Hrs)**
Unit-V	**Cryptographic Hash Functions** Application of cryptographic hash functions: Message Authentication, other applications, Two simple hash functions, Requirements and security, hash function based on cipher block chaining, Secure hash algorithm (SHA-512), Message Authentication Requirement, Message Authentication functions, Message Authentication Code: Requirement, Security, Cryptanalysis. **(6 Hrs)**
Unit-VI	**Security in Networks** Threats in networks, Security Controls- Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Key Management and distribution, Digital signature, Digital Certificate. **(6 Hrs)**

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Cryptography and Network Security	William Stallings	Pearson Education	6th
2.	Cryptography and Network Security	Atul Kahate	McGraw Hill Education.	3rd
3.	Cryptography and Network Security	Behrouz A. Forouzan	Tata Mc Graw Hill	1st
4.	Network Security Essentials: Applications and Standards	William Stallings	Prentice Hall	1st

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Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)

Course Code: CSE352 Course: Principles of Compiler Design **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisites	Theoretical foundations of computer science
Objectives	1. To use of formal attributed grammars for specifying the syntax and semantics of programming languages. 2. To have knowledge of the major phases of compilation, particularly lexical analysis, parsing, semantic analysis, and code generation. 3. To design and implement a significant portion of a compiler for a language chosen by the instructor.
Unit-I	**Introduction to Compilers** Introduction to compilation and programming languages, Interpreter, Compiler, Phases of compiler, compiler writing tools. **Lexical analysis** The role of lexical analyzer, design of lexical analyzer, Implementation of transition diagram, Regular expressions, definition of regular expressions, finite automata theory. Automatic Recognition of REG (LEX), Limitations of Regular Expressions. Implementation of lexical analyzer. **(6 Hrs)**
Unit-II	**Basic Parsing Techniques** Review of context free grammar, Parsers, Shift reduce parsing, Operator precedence parsing, Operator precedence grammar, operator precedence algorithm, Top down parsing, Recursive descent parsing, Left Factoring, Predictive parser, FIRST and FOLLOW, construction of parsing table, LL(1) Grammars. Introduction to YACC tool. **(6 Hrs)**

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Unit-III	**Automatic Construction of Efficient Parsers** LR Parsers, LR Grammars, The canonical collection of LR (0) Items , Construction of SLR Parsing Tables, Constructing canonical LR parsing Tables, Constructing LALR parsing Table. Using Ambiguous grammars, Automatic Parser Generator, Implementation of LR Parsing Tables. Constructing LALR Sets of Items. **(6 Hrs)**
Unit-IV	**Syntax Directed Translation (SDT)** SDT Schemes, Implementation of SDT, S, L-attributed grammar, Intermediate code, Control flow in postfix code, Syntax directed translation to postfix code, Parse trees and syntax trees, Three address code, Quadruples and triples, Translation of assignment statements, Boolean expressions, Postfix Translations. **(6 Hrs)**
Unit-V	**Symbol Table** The contents of a symbol table, reusing symbol -table space, Array names, Storage allocation information, Data Structures for symbol table, Representation of scope. **Code optimization** Finding Loops and Loop Invariant Code, Strength Reduction, Constant Propagation and Constant Folding, Basic Induction Variable recognition. The Principal sources of optimization, Loop Optimization, The DAG representation of Basic Blocks. **(6 Hrs)**
Unit-VI	**Error Detection and Recovery** Errors, Lexical phase errors, Syntactic phase errors, Error Recovery in LR Parsing, Automatic Error Recovery in YACC. **Run Time Storage Administration** Implementation of a Simple Stack -Allocation Scheme, Activation Record, Implementation of Block structural Languages. **Code generation** Object programs, Problems in code generation, A simple code generator, The code generation algorithm. **(6 Hrs)**

	Sr. No.	Title	Author	Publication	Edition
Textbooks / Reference Books	1.	Principles of Compiler Design	A. Aho, M. Lam, R. Sethi and J. Ullman	Addison Wesley	2nd
	2.	Modern Compiler Design	David Galles	Pearson Education	2nd
	3.	Advanced Compiler Design & Implementation	Steven S. Muchnick	Morgan Kaufmann	5th

(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)	
Course Code: CSE353 Course: Machine Learning **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisites	Basic knowledge of probability and statistics
Objectives	1. To understand issues and challenges of Machine Learning. 2. To understand basics of machine learning. 3. To explore supervised and unsupervised machine learning approaches. 4. To introduce Ensemble Techniques and Deep Neural network
Unit-I	**Introduction to Machine Learning** Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation, , over fitting, Instance based learning, Feature reduction, Collaborative filtering based recommendation **(6 Hrs)**
Unit-II	**Supervised Learning -1** Probability and Bayes learning, , Linear regression, Logistic Regression. **(5 Hrs)**
Unit-III	**Supervised Learning - 2** Decision trees, k-NN, Random Forest , Support Vector Machine, Kernel functions. **(7 Hrs)**
Unit-IV	**Unsupervised Learning** Clustering k-means, adaptive hierarchical clustering, Gaussian mixture model. Hierarchical Based clustering methods - Partitioning methods - Grid based methods -K means clustering. **(6 Hrs)**

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Unit-V	**Ensemble Techniques** Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, PAC learning model, Sample complexity, VC Dimension, Ensemble learning. **(6 Hrs)**
Unit-VI	**Neural Networks** Activation functions, network training, Perceptron, multilayer network, back propagation, introduction to deep neural network. **(6 Hrs)**

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Introduction to Machine Learning	Ethem Alpaydin	MIT Press	3rd
2.	Pattern Recognitionand Machine Learning	Christopher M. Bishop	Springer	1st
3.	Foundations of Machine Learning	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar	MIT Press	2nd
4.	Machine Learning	Tom M Mitchell	McGraw Hill Education	1st

(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)	
Course Code: CSE354 Course: Cloud Computing **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Prerequisites	Computer Network, Programming Skill, Database Management System
Objectives	1. To learn and understand basic concepts of Cloud Computing & its Models. 2. To learn and understand Cloud Technologies 3. To design, develop and deploy Cloud applications. 4. To get acquainted with the challenges and security aspects of Cloud Computing.
Unit-I	**Introduction to Cloud Computing** Parallel & Distributed Computing, Cluster Computing, Grid Computing, Definition and Evolution of Cloud Computing, the Vision of Cloud Computing, Cloud Deployment Models, Cloud Service Models, Key Characteristics, Benefits, Risks & Challenges in Cloud Computing. **(6 Hrs)**
Unit-II	**Cloud Computing Architecture** Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud, Interoperability and Standards, Scalability and Fault Tolerance. **(6 Hrs)**

Unit-III	**Enabling Cloud Technologies** Web services: XML, SOAP, REST Virtualization: Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization and Cloud computing, Pros and Cons of Virtualization, Technology Examples- VMware and Microsoft Hyper-V **(6 Hrs)**
Unit-IV	**Security in the Cloud** Cloud Security, cloud Security Challenges, Infrastructure security: Network, Host and Application, VMSecurity Issues, Data security and storage, Security Management in the cloud, Secure Software Development Life Cycle (SecSDLC), Security Monitoring and Incident Response, Security Architecture Design, Data Privacy, Life cycle of Data,Key Privacy Concerns in cloud and Disaster Recover. **(6 Hrs)**
Unit-V	**Aneka: Cloud Application Platform** Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, Foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools. **(6 Hrs)**
Unit-VI	**Cloud Applications** Scientific Applications – Health care, Business and Consumer Applications- CRM and ERP, Social Networking. **Cloud Platforms in Industry:** Amazon Web Services- Compute Services, Storage Services, Communication Services and Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life-Cycle, cost model. Microsoft Azure- Azure Core Concepts, SQL Azure. **(6 Hrs)**

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	Sr. No.	Title	Author	Publication	Edition
Textbooks / Reference Books	1.	Enterprise Cloud Computing: Technology, Architecture, Applications	Gautam Shroff	Cambridge University Press	1st
	2.	Cloud computing Bible	Barrie Sosinsky	Wiley India Pvt Ltd (2011)	1st
	3.	Cloud Computing Implementation, Management, and Security	John W. Rittinghouse,James F. Ransome	CRC Press	1st
	4.	Mastering Cloud Computing	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi	TMH2013.	43th
	5.	Cloud Computing	Dr. Kumar Saurabh	Wiley India	2nd

Faculty of Science & Technology Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester VI)	
Course Code: AED391 Course: Open Elective-III: Fundamentals of Bioenergy **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic knowledge of Bioenergy sources and biomass utilization
Objectives	1. Understand bioenergy technologies, processes, reactions and energy conversion rates for Anaerobic Digestion, gasification, pyrolysis (fast, intermediate and slow) and combustion 2. Know what constitutes a suitable feedstock for bioenergy applications
Unit-I	**Introduction to bioenergy-** Introduction, Unit of Energy and Introduction of Bioenergy, How Biomass Formed on the Earth, Basic Biomass Technology (Resources and Production) Biomass Production: Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. **(6 Hrs)**
Unit-II	**Bioethanol-** Biofuels: Introduction, Ethanol production process, Biodiesel production process, Environmental Benefits, Bio-oil: Pyrolysis or Destructive distillation. **(6 Hrs)**
Unit-III	**Biogas-** Biogas: Introduction, process description, Constituents of biogas, main features of biogas plant, Classification & Popular designs, Applications, factors considered for selection of biogas plant, advantages, disadvantages. **(6 Hrs)**
Unit-IV	**Biodiesel-** Biodiesel production processes, Biodiesel characterization, Biodiesel feedstocks, Environmental permitting and safety considerations for biodiesel production. **(6 Hrs)**
Unit-V	**Thermo Chemical Processes:** Basic concepts in gasification and pyrolysis, chemistry of gasification, Gasification Types – Updraft Gasifier, downdraft, cross draft, applications, difference. **(6 Hrs)**

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Unit-VI	**Biomass utilization:** Biomass densification technique (briquetting, pelletization, and cubing), environmental aspect of bio-energy, waste to energy conversion. **(6 Hrs)**				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1	Introduction to Bioenergy (Energy and the Environment)	Vaughn C. Nelson, Kenneth L. Starcher	CRC Press	1st
	2	Bioenergy: Biomass to Biofuels	Anju Dahiya	Elsevier Science	2nd
	3	Bioenergy: Principles and Applications	Yebo Li and Samir Kumar Khanal	Wiley	2nd

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(Faculty of Science & Technology) Syllabus of T. Y. B.Tech. Civil Engineering (Semester VI)	
Course Code: CED391 Course: Open Elective-III: Solid Waste Management **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	Environmental Science
Objectives	To get introduced to the generation, collection and management of the various types of solid waste and different waste management techniques.
Unit-I	**Introduction to Solid Waste Management (SWM):** Need and Objectives, Waste Management Hierarchy, Functional elements, Environmental impact of mismanagement. Solid waste: Sources, types, Composition, Quantities, Physical, chemical and biological properties. **(06 Hrs)**
Unit-II	**Generation of solid waste: Factors affecting. Storage and collection:** General considerations for waste storage at source, Types of collection Systems, Transfer station: Meaning, Necessity, Transportation of solid waste: Means and Methods, Routing of vehicles. **(06 Hrs)**
Unit-III	**Segregation and Material Recovery:** Objectives, Stages of segregation, sorting operations, Guidelines for sorting for materials recovery, E waste management, Biomedical waste management. **(06 Hrs)**
Unit-IV	**Waste processing: processing technologies**: Composting, thermal conversion technologies incineration, treatment of biomedical wastes. Energy recovery from solid waste: Parameters affecting energy recovery, Bio-methanation, Fundamentals of thermal processing, Pyrolysis, Incineration, Advantages and disadvantages of various technological options. **(06 Hrs)**
Unit-V	**Disposal:** Landfills and its introduction, Definition, Essential components, Site selection, Land filling methods, Leachate analysis and landfill gas management,

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<table>
<tr><td></td><td colspan="5">treatment & disposal, Determination of capacity of landfill disposal site. (06 Hrs)</td></tr>
<tr><td>Unit-VI</td><td colspan="5">Hazardous waste management (HWM): Types of hazardous waste (such as nuclear, biomedical and industrial waste), problems and issues related to HWM, Need for HWM, Legislations on management and handling of HW, Hazardous Characteristics, reduction of wastes at source, Recycling and reuse, labelling and handling of hazardous wastes, incineration, solidification & stabilization of hazardous waste. (06 Hrs)</td></tr>
<tr><td rowspan="6">References</td><td>Sr. No.</td><td>Title</td><td>Author</td><td>Publication</td><td>Edition</td></tr>
<tr><td>1</td><td>Integrated Solid Waste Management</td><td>Hilary Theisen and Samuel A, Vigil</td><td>McGraw- Hill, New York</td><td>1993</td></tr>
<tr><td>2</td><td>CPHEEO, Manual on Municipal Solid waste management,</td><td>Central Public Health and Environmental Engineering Organization</td><td>Government of India</td><td>2000</td></tr>
<tr><td>3</td><td>Environmental Resources Management, Hazardous waste Management</td><td>Michael D. LaGrega, Philip L Buckingham Jeffrey C. E vans</td><td>Mc-Graw Hill International edition</td><td>2001</td></tr>
<tr><td>4</td><td>Solid waste Engineering</td><td>Vesilind P.A., Worrell W and Reinhart</td><td>Thomson Learning Inc., Singapore</td><td>2002</td></tr>
<tr><td>5</td><td>Hazardous Waste Management</td><td>Charles A. Wentz</td><td>McGraw Hill International Edition,New York</td><td>2nd</td></tr>
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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)	
Course Code: CSE391 Course: Open Elective-III: RHCSA (RedHat Certified System Administration) **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Prerequisites	This course has prerequisites like previous system administration experience on other operating systems is beneficial. Fundamental knowledge of Operating System.
Objectives	1. Develop a strong understanding of the command-line interface (CLI) and become proficient in using essential command-line tools and utilities for system administration tasks. 2. Understanding fundamental system administration tasks, such as managing file systems, users, and groups. 3. Ability to Install, update, and remove software packages using package management tools and service management. 4. Ability to identify and resolve common system issues, perform system analysis, and troubleshoot problems related to hardware, software. 5. Ability to configure and troubleshoot network interfaces and handling system security. 6. Ability to manage storage devices and file systems and utilize containerization tools like Podman.
Unit-I	**Introduction to Red Hat Enterprise Linux (RHEL, Filesystem and File Permissions** Overview of RHEL and its features. Installation and deployment of RHEL, Filesystem hierarchy standard (FHS), Managing files and directories. **(6 Hrs)**

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Unit-II	**User and Group Administration** Permissions and ownership User and group management, Password policies and authentication methods, User and group quotas user and group-level security measures, such as password policies and file permissions, to maintain system integrity. **(6 Hrs)**
Unit-III	**Package Management, System Initialization** Package installation, removal, and verification Managing software repositories, Dependency resolution and package querying, Boot process and run levels Managing services and daemons, Systemd and SysVinit. **(7 Hrs)**
Unit-IV	**System Maintenance, Troubleshooting and System Recovery** System updates and patching, Kernel management, Managing log files and system monitoring, System troubleshooting methodologies, Rescue and recovery techniques, Boot loader configuration and troubleshooting. **(7 Hrs)**
Unit-V	**Network Configuration** Network interfaces and configurations, IP addressing and routing, DNS configuration. configuring firewalls, securing SSH access, and implementing SELinux policies to protect the system from unauthorized access and potential threats. **(7 Hrs)**

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Unit-VI	**Storage Administration & Run containers** Disk partitioning and formatting, Logical Volume Manager (LVM), Filesystem creation and mounting, Deploy Container, Manage Container Storage and Network Resources, Manage Containers as System Services. **(7 Hrs)**

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Linux System Programming	Robert Love	O'Reilly, SPD	10th
2.	UNIX Network Programming	W.R. Stevens	McGraw-Hill	5th
3.	Linux Command Lineand Shell Scripting Bible	Richard Blum and Christine Bresnahan	McGraw Hill	6th
4.	UNIX and Linux System Administration Handbook	Evi Nemeth, Garth Snyder, Trent R. Hein	Ben Whaley	3rd
5.	RHCSA/RHCE Red Hat Linux Certification Study Guide	RedHat Student Guide	RedHat	9th

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)	
Course Code: CSE392 Course: Open Elective-III: Digital Marketing **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisites	Basic Understanding of Digital Marketing
Objectives	1. To understand the basic concept of digital marketing 2. To understand the concept of search engine optimization. 3. Implement Social Media Optimization 4. Discuss the concept of google advertising
Unit-I	**Digital Marketing Introduction** Concept of Digital Marketing, Use of Digital Marketing, Digital Marketing Platform, Digital Marketing Strategy, Types of Digital Marketing – Organic & Paid, Digital Marketing VS Traditional Marketing. How is it different from traditional marketing, ROI between Digital and traditional Marketing. **7 Hrs)**
Unit-II	**Search Engine Optimization (SEO)** Introduction of SEO, Search Engine working, SEO Tools Web position Analysis, Competition Analysis, Google Algorithms and Updates. **(6 Hrs)**
Unit-III	**Social Media Optimization (SMO)** **Facebook** - Profile Creations, Creating groups and pages, Tips and Guides, Posts And promotions, Events Creations, Video Marketing, Promotional Techniques, Integration Techniques. **Twitter** -Set-up and usage Tips, Promoted Tweets, Video Marketing, Promotional Techniques, Integration Techniques, Analytics.

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	LinkedIn-Profile Creations, Company Page Creations, Tips and Guides, LinkedIn posts LinkedIn promotions LinkedIn Groups, Video Marketing, Promotional Techniques, Integration Techniques, **Instagram** -Integration Techniques, Promotional Techniques. **(5 Hrs)**
Unit-IV	**Introduction to SEM** Google AdWords, Search Advertising, Display Advertising, Mobile Advertising, Video Advertising, Shopping Advertising, Report generation, Google AdWords Express, Setup, Google Mapping Ads. **(6 Hrs)**
Unit-V	**E-Commerce Management** Maintenance of an online product-listing website through product keyword research, product pricing, positive reviews, and customer retention. **(6 Hrs)**
Unit-VI	**Email Marketing** How to create and send product-based emails in bulk, and ensure that all of the emails have a good open rate and conversion rate. **(6 Hrs)**

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Digital Marketing For Dummies	Ryan Deiss & Russ Henneberry	Tata McGraw Hill	6th
2.	Social Media Marketing All-in-one Dummies	Jan Immerman, Deborah Ng	Prentice Hall	3rd
3.	Digital Marketing	Seema Gupta	Tata McGraw Hill	1st

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(Faculty of Science and Technology) Syllabus of T. Y. B.Tech. Electronics and Computer Engineering (Semester VI)	
Course Code: ECE391 Course: Open Elective-III: Data Science **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II:15 Marks Teacher Assessment:10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination(Duration): 2Hrs.
Prerequisites	Programming Concepts, Data Structure, Basic Linear Algebra, Basic Probability and Statistics.
Objectives	The objectives of the course are • Give an introduction to data science and its applications. • Understand use of statistics in data science • Usedatasciencetoanalyzelargeandunstructureddatawithdifferenttools
Course Outcomes	At the end of the course the student will be able to 1. Demonstrate the fundamental concepts and principles of data science. 2. Apply data preprocessing techniques to clean and prepare data for analysis. 3. Perform statistical analysis and interpret the results. 4. Implement and evaluate machine learning algorithms for data prediction and classification.
Unit-I	**Introduction to Data Science:** Overview of Data science and its terminologies, Applications of Data Science, Role of Data science in emerging technologies. Data types and Data sources, Data preprocessing techniques, Statistical concepts for Data Science. **(6 Hrs.)**
Unit-II	**Machine Learning for Data Science:** Introduction to machine learning algorithms, Supervised learning: linear regression, logistic regression, decision trees, and random forests, Unsupervised learning: clustering algorithms, dimensionality reduction, Feature generation and selection using Machine learning. **(6 Hrs.)**

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Unit-III	**Data Visualization and Communication:** Principles of data visualization, Exploratory data analysis using visual techniques Tools and libraries for data visualization. Mining Social Networks: Social Networks graphs, clustering of graphs, direct discoveries of communities in graphs, analyze the portioning of graphs, the neighborhood properties of graphs. **(6 Hrs.)**
Unit-IV	**Big Data Analytics and cloud computing for Data Science:** Introduction to big data and its challenges, Distributed computing frameworks: Hadoop and Spark, Big data processing and analysis. Cloud concept and computing for data science. **(6 Hrs.)**
Unit-V	**Programming Languages and libraries for Data Science:** Python for Data Science, Python libraries for data science. R programming language for Data science. Implementation examples in Python and R language. **(6 Hrs.)**
Unit-VI	**Ethical Considerations in Data Science:** Privacy, security, and ethical considerations in data science, Bias, fairness, and interpretability in machine learning algorithms, Legal and regulatory aspects of data science. **(6 Hrs.)**

References

Sr.No.	Title	Author	Publication	Edition
1.	Python for Data Analysis	Wes McKinney	O'Reilly Media	2nd
2.	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2nd
3.	Data Science for Business	Foster Provost, Tom Fawcett	O'Reilly Media	1st
4.	Hands-On Machine Learning with Scikit-Learn and TensorFlow	Aurélien Géron	O'Reilly Media	2nd
5.	Doing Data Science: Straight Talk from The Frontline	Cathy O 'Neiland Rachel Schut	O'Reilly Media, Inc	3rd

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(Faculty of Science and Technology) Syllabus of T. Y. B.Tech. Electronics and Computer Engineering (Semester VI)	
Course Code: ECE392 Course: Open Elective-III: Control Systems **Teaching Scheme:** Lectures: 3 Hrs./ Week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks MidSemesterExamination-II:15 Marks Teacher Assessment:10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination(Duration): 2Hrs.
Prerequisites	Linear algebra and calculus
Objectives	The objectives of the course are • The objective of this course is to introduce students to the fundamental concepts and principles of control systems. • Students will develop an understanding of the analysis and design of control systems, including time-domain and frequency-domain techniques.
Course Outcomes	At the end of the course the student will be able to 1. Understand the basic concepts and terminology of control systems. 2. Analyze linear time-invariant (LTI) systems using Laplace transforms and transfer functions. 3. Design and analyze feedback control systems using time-domain techniques. 4. Analyze control system stability using Routh-Hurwitz and Nyquist criteria.
Unit-I	**Introduction to Control Systems** Definition and classification of control systems, Feedback and feedforward control, Open-loop System, closed-loop control and their examples. Distinguish between open and close system. Laplace transforms. **(6 Hrs)**
Unit-II	**Mathematical Modeling of Dynamic Systems** Differential equations and transfer functions, Advantages, Disadvantages and Properties of Transfer function, transfer function representation, Block diagrams and signal flow graphs, State-space representation. **(6 Hrs)**

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Unit-III	**Time-Domain Analysis** Time response analysis, Step response analysis. Time constant and system behavior. Transient and steady-state response, Second-order system characteristics: Step response analysis. Natural frequency and damping ratio. Un damped, under damped, critically damped, and over damped systems Performance specifications: Rise time, settling time, peak time, and peak overshoot. Steady-state error and error constants. Introduction to error analysis. **(6 Hrs)**
Unit-IV	**Stability Analysis:** Definition of stability, Stability conditions based on the Routh array, Application of the Routh-Hurwitz criterion to analyze system stability. Nyquist stability criterion, Application of stability criteria to determine system stability. **(6 Hrs)**
Unit-V	**Frequency-Domain Analysis:** Frequency response analysis, Relationship between time-domain and frequency-domain representations, Bode plots, Nyquist stability criterion, Stability margins, gain margin and phase margin. **(6 Hrs)**
Unit-VI	**Controller Design:** Sensors and actuators, Sampling and discrete-time control systems, Proportional-Integral-Derivative (PID) controllers, Frequency response design (lead, lag, and lead-lag compensation), Digital controllers and hardware implementation. **(6 Hrs)**

References

Sr.No.	Title	Author	Publication	Edition
1.	Modern Control Engineering	Katsuhiko Ogata	--	--
2.	Control Systems Engineering	Norman S. Nise	--	--
3.	Feedback Control of Dynamic Systems	Gene F. Franklin, J. David Powell, and Abbas Emami-Naeini	--	--
4.	Automatic Control Systems	Benjamin C. Kuo and Farid Golnaraghi	--	--

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Syllabus of T. Y. B.Tech. Electrical Engineering (Semester VI)

Course Code: EED391 Course Title: Open Elective-III: Special Purpose Electric Machines **Teaching Scheme:** Theory: 3 Hrs / week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	Basic electrical Engineering, magnetic circuit, conventional electrical machines
Objectives	1. To understand different types of motors for particular application 2. To examine behaviour of machines for specific applications 3. To compare different machines 4. To develop knowledge in regards of control and use of machines
Unit-I	**Induction Generators** Construction, operating principle, types, operating characteristics, Applications. **(6 Hrs)**
Unit-II	**Doubly fed induction Machines** Construction, operating principle, types, operating characteristics, Applications to grid connected wind and mini/micro hydel systems. **(6 Hrs)**
Unit-III	**Switched Reluctance Moto** Construction, operating performance, control and applications. **Variable reluctance stepper motor** Construction, operating performance, control and applications. **(6 Hrs)**
Unit-IV	**Linear Machines** Linear Induction Machines and Linear Synchronous Machines: Construction, operation, performance, control and applications. **(6 Hrs)**
Unit-V	**BLDC Machine** Construction, magnetic materials used, types of motors , control and applications. Recent developments in BLDC motors. **(6 Hrs)**

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Unit-VI	**Permanent Magnet Machines** Construction, magnetic materials used, types of motors e.g. PMDC and PM Synchronous Machine, control and applications. Recent developments in electrical machines. **(6 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1	Switched Reluctance motor drives'	R. Krishnan,	CRC press, 2001	1st Edition
2	Permanent magnet and Brushless DC motors'	T. Kenjo and S. Nagamori	Clarendon press. London, 1988	1st Edition
3	Special Electrical Machines	Simmi P Burman	S.K. Kataria& Sons	2nd Edition
4	Permanent Magnet Synchronous and Brushless DC Motor Drives	R. Krishnan.	New Delhi, Prentice, Hall of India, 2009	2nd Edition
5	Special Electrical Machines	Venkataratnam	Taylor and Francis, 2009	1st Edition

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Artificial Intelligence & Data Science (Semester VI)	
Course Code: AID391 Course: Open Elective-III: Business Intelligence **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Prerequisites	No Prerequisites
Objectives	1. Student should learn fundamental concepts of Business Intelligence. 2. To learn analytics framework to support decision making in business intelligence.
Unit-I	**Understanding Business Intelligence** The Challenge of Decision Making, What Is Business Intelligence?, The Business Intelligence Value Proposition, The Combination of Business and Technology (6 Hrs)
Unit-II	**Business Intelligence Technology Counterparts** Data Warehousing: What Is a Data Warehouse?, Data Marts and Analytical Data, Organization of the Data Warehouse Enterprise Resource Planning: Distributing the Enterprise, First ERP, then Business Intelligence, The Current State of Affairs Customer Relationship Management: CRM, ERP, and Business Intelligence Customer Decisions, Decisions About Customers, Business Intelligence and Financial Information (6 Hrs)
Unit-III	**The Spectrum of Business Intelligence** Enterprise and Departmental Business Intelligence, Strategic and Tactical Business Intelligence, Power and Usability in Business Intelligence, Finding the Right Spot on the Continuum, Business Intelligence: Art or Science? (6 Hrs)

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Unit-IV	**Business Intelligence User Interfaces** Querying and Reporting, Reporting and Querying Toolkits, Basic Approaches: Building Ad-Hoc Queries, Building On-Demand Self-Service Reports, Enhancing and Modifying, Data Access: Pull-Oriented Data Access, Push-Oriented Data Access, Dashboards: EIS Is the Engine, Metric System and KPIs, Business Intelligence Dashboards (6 Hrs)
Unit-V	**On-Line Analytical Processing (OLAP)** OLAP:OLAP and OLTP, Operational Data Stores, Variations in Data and Approach, OLAP Applications and Functionality, Multi-Dimensions: Thinking in More Than Two Dimensions, What Are the Possibilities?, Drilling and Pivoting, OLAP Architecture: Cubism, Tools, ROLAP, MOLAP, HOLAP, Data Mining (6 Hrs)
Unit-VI	**Visualization, Guided Analysis and** Visualization: The Basics, Unconstrained Views, Guided Analysis: The Business Intelligence Two-Step, How to Guide the Guides, Handling Unstructured Data (6 Hrs)

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1	Decision Support and Business Intelligence Systems	Efraim Turban, Ramesh Sharda, Jay Aronson, David King	Pearson Education, 2009.	9th
2	The Savy Manager's Guide Getting Onboard with Emerging IT	David Loshin, Business Intelligence	Morgan Kaufmann Publishers.	2009

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Mechanical Engineering (Semester VI)	
Course Code: MED391 Course: Open Elective-III: Industry 4.0 **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Course Objectives	1. To make students aware of the structure and role of Industry 4.0, in current evolving industrial environment. 2. To give learners overview of Industry 4.0 technologies and their integration.
Unit I	**Introduction-** Four industrial revolutions, Digital transformation of Industry and the fourth industrial revolution, Scope of Industry 4.0, Automation pyramid and Industry 4.0, Principles of Industry 4.0. **(6 Hrs)**
Unit II	**Internet of Things (IoT)–** Concept of IoT, IoT Architecture – Sensing layer, Network layer, Data processing layer, Application layer, Applications of IoT – for automobiles, homes, etc. Internet of Service (IoS), Internet of Energy (IoE). **(6 Hrs)**
Unit III	**Technologies in Industry 4.0 (1)-** Augmented reality and Virtual Reality, 3D Printing, Collaborative robots, Smart material handling, Smart sensors, Concept of smart products. **(6 Hrs)**
Unit IV	**Technologies in Industry 4.0 (2)-** Machine learning, Introduction to Cyber Physical Systems (CPS), Components of Cyber Physical Systems, Digital twins, Machine vision, Smart factory, Artificial intelligence. **(6 Hrs)**
Unit V	**Data in Industry 4.0-** Big Data, Data Mining, Data Analytics, Cloud computing, Data – anew resource of organization, Data analysis for optimal decision making, Digitalization of the entire value chain. **(6 Hrs)**

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Unit VI	**Applications of Industry 4.0-** Industry 4.0 in Manufacturing – Predictive maintenance, Real-time supply-chain optimization, Digital performance management, Smart energy consumption, Challenges in implementing Industry 4.0. **(6 Hrs)**

Textbook/ Reference Books

Sr. No.	Title	Author	Publication	Edition
1	Industry 4.0 - the Industrial Internet of Things	Industry 4.0_ the Industrial Internet of Things	Industry 4.0_ the Industrial Internet of Things	-
2	Industry 4.0- Managing The Digital Transformation	Alp Ustundag, Emre Cevikcan	Springer	1st
3	Automated Manufacturing System	Hugh Jack	Lulu.com	7th
4	Industry 4.0- Opportunities Behind The Challenge	Dr. Mirjana Stankovic, Ravi Gupta and Dr. Juan E. Figueroa	UNIDO General Conference 2017	-
5	Handbook of Ind. Automation	Richard L. Shell Ernest L. Hall	CRC Press	1st

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Faculty of Science & Technology Syllabus of T. Y. B. Tech. Mechanical Engineering (Semester VI)	
Course Code: MED392 Course: Open Elective-III: Operations Research **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continues Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Objectives	1. To familiarize the students with formal quantitative approach to problem solving 2. To formulate real life engineering problems 3. To solve engineering problems using various Operations Research Techniques
Unit-I	**Introduction to Operations Research :** Basics definition, scope, objectives, phases, models, applications and limitations of Operations Research. **(2 Hrs)**
Unit-II	**Linear Programming Problem :** Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, Big-M method, two-phase method, degeneracy and unbound solutions. **(8 Hrs)**
Unit-III	**Transportation Model :** Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test – the stepping stone method or MODI method. Degeneracy in Transportation Problem. **(8 Hrs)**
Unit-IV	**Assignment Problem:** Hungarian Method to solve Assignment Problem, Travelling Salesman as an Extension of Assignment Problem. **(4 Hrs)**

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Unit-V	**Queuing model and Sequencing model :** Queuing Systems And Structures, Notation Parameters, Single Server and Multi Server Models, Poisson Input, Exponential Service, Constant Rate Service, Infinite Population Sequencing Model: Introduction, n jobs through two machines, n jobs through three machines, two jobs through m machines and n jobs through m machines. **(6 Hrs)**
Unit-VI	**Network Models:** Fulkerson's rule, concept and types of floats, float calculations, CPM and PERT, Crashing cost and crashing Network. **(8 Hrs)**

Text Book/ Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Operations Research	Taha H.A.	Prentice Hall Of India.	Ninth Edition
2.	Introduction to Operations Research	Frederick S. Hillier and Gerald J. Lieberman	Tata McGraw-Hill	Seventh Edition
3.	Operations Research	P.K. Gupta, D.S Hira	S. Chand & Co.	Fourth Edition
4.	Operations Research	Man Mohan, P. K. Gupta, Kanti Swarup	S. Chand & Co.	12th Edition
5.	Operations Research Principles and Practice	Ravindran, Phillips and Solberg	Mc. WSE Willey	Second Edition
6.	Operations Research: Applications and Algorithms	Wayne L. Winston, Jeffrey B. Goldberg	Thomson Brooks	Fourth edition
7.	Operations Research: Theory, Methods and Applications	S. D. Sharma, Himanshu Sharma	Kedar Nath Ram Nath	Fourth Edition
8.	PERT and CPM: Principles and Applications	L. S. Srinath	East-West Press Private Limited,	Third Edition
9.	Project Planning and Control with PERT & CPM	Dr. B.C. Punmia & K.K. Khandelwal	Firewall Media	Fourth Edition

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)	
Course Code: PPE391 Course: Open Elective -III: Waste Management and Circular Economy **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Prerequisite	Plastic materials, processing, rheology, basics of polymer technology and designing
Objectives	• It aims to provide students with a comprehensive understanding of sustainable practices and the principles of the circular economy within the context of polymer engineering. • Students will explore various strategies, technologies, and policies for achieving sustainability, reducing environmental impact, and promoting circularity in the polymer industry. • The course will emphasize the importance of integrating sustainable principles in the design, production, and disposal of polymer materials.
Unit-I	**Topic Title: Introduction to Waste Management and Circular Economy** Definition and significance of sustainability in polymers, basics of waste management, principles and goals of the circular economy, environmental, social, and economic dimensions of waste management, life cycle thinking and assessment in plastics **(4 Hrs)**
Unit-II	**Topic Title: Waste generation, composition, and management** Sources and types of plastic and polymer waste, composition analysis and characterization of waste, quantification and assessment of waste generation, waste management and treatment methods: MSWM processing and plastics waste management comprising of waste hierarchy i.e., prevention, minimization, reuse, recycling, energy recovery, and disposal. **(8 Hrs)**

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Unit-III	**Topic Title: Sustainable Polymer Processing** Energy-efficient processing techniques, clean and green manufacturing practices, waste reduction and recycling in polymer processing, sustainable additives and processing aids **(6 Hrs)**
Unit-IV	**Topic Title: Sustainable Waste Management and Disposal** Waste characterization and classification in polymers, mechanical recycling, waste-to-energy conversion technologies, biological treatment methods for polymer waste, hazardous waste management and regulations, sustainable landfilling and waste disposal practices **(6 Hrs)**
Unit-V	**Topic Title: Circular Economy Strategies** Design for recycling and upcycling principles, closed-loop supply chains and reverse logistics, extended producer responsibility and product stewardship, circular economy business models and initiatives, case studies on successful implementation of circular economy strategies **(6 Hrs)**
Unit-VI	**Topic Title: Policy and Regulatory Framework for Sustainability** International and national policies promoting sustainability in polymers, Environmental regulations and standards for the polymer industry, corporate social responsibility and sustainability reporting, challenges, and opportunities in implementing sustainable practices, future trends and emerging technologies in sustainable polymer engineering **(6 Hrs)**

Textbooks / Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Waste Management and the Circular Economy in Selected OECD Countries	OECD	OECD Publishing	1st Edition, 2019

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	2.	Plastics and Sustainability: Towards a Peaceful Coexistence between Bio-based and Fossil Fuel-based Plastics	Michael Tolinski	Wiley	1st Edition 2011
	3.	Plastics and Sustainability: Towards a Deeper Understanding of the Environmental Role of Plastics in Today's World	Conor P Carlin	Wiley-Scrivener	1st Edition 2021
	4.	Strategic Management for the Plastics Industry: Dealing with Globalization and Sustainability	Jones, Roger F.	CRC Press	1st Edition 2013
	5.	Plastics in the Circular Economy	Vincent Voet, Jager, Rudy and Folkersma	De Gruyter	1st Edition 2023
	6.	A Practical Guide to Plastics Sustainability: Concept, Solutions, and Implementation	Michel Biron	William Andrew Publishers	1st Edition, 2020
	7.	Circular Economy and Waste Valorisation: Theory and Practice from an International Perspective	Jingzheng Ren, Long Zhang	Springer	1st Edition, 2022

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)	
Course Code: CSE371 Course: Lab-I: Cryptography and Network Security **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 Teacher Assessment: 25 Marks
Objectives	1. To implement the fundamental algorithms of Cryptography 2. To apply DES, AES, and RSA in the given scenario.
List of Practical	1. Write a Program to implement Monoalphabetic Cipher 2. Write a Program to implement Caeser Cipher 3. Write a Program to implement Affine Cipher 4. Write a Program to implement Rail fence technique. 5. User A wants to send message "Meet me very urgently" to User B by using DES algorithms encrypt it at sender end and decrypt it at receiver end. 6. User C wants to send message "Welcome to CSE" to User D by using AES algorithms encrypt it and decrypt it at receiver end. 7. User A wants to communicate to user B, but it should be confidential by using Blowfish algorithms to send encrypted messages and decrypt it. 8. User A wants to communicate to user B, but they want to use Asymmetric Key Cryptography by using RSA algorithms to send messages to each other. Encrypt message at sender side and decrypt it at receiver side. 9. Write a Program to implement Secure hash algorithm. 10. Write a Program to implement Digital Signature

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Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)

Course Code: CSE372 Course: Lab-II: Principles of Compiler Design **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 Teacher Assessment: 25 Marks

Objectives	1. To describe the purpose and implementation approach of each phase. 2. To give students practical exposure of theoretical computer science including Languages, Grammar and Machines.
List of Practical	1. Write a program to implement lexical analyzer to separate tokens such as identifier, constant, operator and keyword . 2. Write a program to implement lexical analyzer to separate tokens such as identifier, constant, operator and keyword using Flex Tool. 3. Write a program to implement shift reduce parser. 4. Write a program to implement Recursive Descent Parsing method for following grammar but not restricted to E->E+T/T,T->T*F/F,F->(E)/id 5. Write a program to implement FIRST in predictive parser. 6. Write a program to implement infix to postfix conversion. 7. Write a program in YACC to implement YACC as Calculator. 8. Write a program to generate three address codes for the given set of input expression. Test for the sample input :the three address code for the expression a + b * c + d : Output T1 = b * c, T2 = a + T1,T3 = T2 + d, T1, T2, and T3 are temporary variables. 9. Write a program to implement quadruple form of three address code. 10. Write a program to implement any one code optimization technique.

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)	
Course Code: CSE373 Course: Lab-III: Machine Learning **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 End Semester Examination/Oral: 25 Marks

Objectives	1. To understand & apply classification and regression algorithms. 2. To understand & implement supervised machine learning to solve problems. 3. To understand & apply unsupervised machine learning to solve problems.
List of Practical	1. Understand the Python Libraries required for ML application such as Numpy , Pandas and Matplotlib and implement simple programs using these libraries. 2. Write a python program using Statistics library to compute Central tendency measures: Mean, Median, Mode Measures of Dispersion: Variance, Standard Deviation 3. Write a Python program to implement Simple Linear Regression for diabetes dataset. 4. Implement Multiple Linear Regression for House Price Prediction using sklearn. 5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets. 6. Implement Decision tree using sklearn and its parameter tuning . 7. Write a program to implement K-Nearest Neighbour algorithm. 8. Implement Logistic Regression using sklearn to predict whether the patient is diabetic or not. 9. Write a program to implement SVM algorithm. 10. Apply K-means algorithm to cluster a set of data stored in a .csv file.

(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)	
Course Code: CSE374 Course: Lab-IV: Cloud Computing **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 End Semester Examination/Oral: 25 Marks
Objectives	1. To learn the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability. 2. To understand the basic ideas and principles in data center design, cloud management techniques and cloud software deployment considerations. 3. To understand Different CPU, memory and I/O virtualization techniques that serve in offering software, computation, and storage services on the cloud.
List of Practical	1. Develop any application in Google colab (SaaS) using C and Python. 2. Develop any one application in Code any where using C, C++, Java orPython (PaaS) 3. Creating a Warehouse application in SalesForce.com. 4. Adding Master Detail and Lookup Relationship to the objects using Salesforce.com. 5. Implementation of Web services in SOAP for JAVA Applications. 6. Installation and configuration of virtual machine with guest OS. Implement Application Virtualization using WINE on Ubuntu 7. Analyse architecture of Moodle cloud portal and Moodle cloud site and create different entities dynamically. 8. Implement and use sample cloud services with the help of Microsoft Azure. 9. Categorize Amazon Web Service (AWS) and implement its various cloud entities using its Cloud Toolbox support. 10. Develop any one application in AWS Cloud9 (PaaS) using Java or Python/PHP.

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(Faculty of Science & Technology) Syllabus of Third Year B. Tech. (All) Semester VI	
Course Code: CSE375 Course: Lab-V: Major Project-I **Teaching Scheme:** Practical: 4 Hrs/week	Credits: 0-0-2 Teachers Assessment: 25 Marks End Semester Examination/Oral: 25 Marks

Objectives	Solve a real life societal problem through research based approaches
Course Outcome	Upon the completion of this course the students will be expected to: 1. Formulate an analytical model for an engineering problem and obtain its solution with necessary tools. . 2. Perform and manage as an individual or as a member of a team with ethical values. 3. Examine the concepts of environment and sustainability 4. Write effective reports and communicate effectively on civil engineering problems. 5. Present the conclusions in a way to benefit the society.
Instructions to Students	Solving a real life problem should be the focus of under graduate projects. Faculty members should prepare project briefs (giving scope and references) well in advance which should be made available to the students at the departmental level. The project may be classified as hardware / software / modelling / simulation. It may comprise any elements such as analysis, design, synthesis, validation etc. Interdisciplinary/Multidisciplinary projects are encouraged.
Guidelines	The department will appoint a project coordinator who will coordinate the following. 1. Grouping of students (a maximum of 3/4 in a group) 2. Allotment of projects and project guides 3. Project monitoring at regular intervals. All projects allotments are to be completed as given in the Academic Calendar. All projects will be monitored at least twice in a semester through students' presentation and will be conducted as per Academic Calendar.

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Distribution of marks for TA shall be as follows:

Problem Statement 10; Literature Review 10; Group formation and identification of individual responsibility10; Objective of Project activity 10; Knowledge of domain, technology and tools being used 10.

For TA 50 Marks to be converted to 25 Marks.

Distribution of marks for ESE/Oral shall be as follows:

Realization of project as per problem statement 10; Design & Testing 30; Documentation and Report Writing 20; Quality of Work 15; Performance in Question & Answers Session 15; Timely Completion of Project work 10

For ESE/Oral – 100 Marks to be converted to 25 Marks.

Efforts be made to carry out industry based/ Societal Projects. Problems can also be invited from the industries/Society to be worked out through undergraduate projects.

In case of Interdisciplinary/Multidisciplinary Projects, as per the requirements, a greater number of Guides may be appointed. A Joint committee of involved departments shall conduct the review of the students.

The students shall aim to promote their project work in project exhibitions/competitions, paper presentation/publication in reputed journals and conferences.

The relevance of project and implementation including details of attainment of POs and PSOs addressed through the projects with justification must be clearly stated.

Phases of Major Project - I:

Phase I: Need Statement, Literature Review, data collection, Problem Statement, Objectives, Scope, Analysis/Framework/ Algorithm

Phase II: Details of Hardware & Software, Methodology, and Implementation plan for next semester.

Phase III: Submission of report of project work.

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